DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Information Processing Technology Office (IPTO)
PLANNED PROCUREMENTS
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Program Description	Funding	Schedule	Program MGR
Augmented Cognition (AugCog): The DARPA Augmented Cognition program seeks to extend, by an order of magnitude or more, the information management capacity of the human-computer warfighting integral by developing and demonstrating quantifiable enhancements to human cognitive ability in diverse, stressful, operational environments. Specifically, this program will develop the means to measure a subject's cognitive state and manipulate it to create the ability to successfully accomplish the functions currently carried out by three or more individuals. A key objective of the program is to foster development of novel prototypes and enabling technologies in order to understand the means by which they may be integrated into existing operational systems, as well as those in development. The program will accomplish this by delivering new design principles and enabling technology for human-computer symbiosis. This program will develop and evaluate technology that will enable: (1) real-time detection of cognitive state; (2) real-time manipulation of cognitive state; (3) autonomous manipulation of cognitive state; and (4) operationally relevant demonstrations of these capabilities.	TBD	BAA 01-38 Open through: 9/11/02Total program: 5 years	LCDR Dylan Schmorrow IPTO
Mobile Autonomous Robot Software (MARS): The MARS program focuses on machine learning and perception for effective navigation in diverse real-world environments and effective interaction with humans. Technical development is divided into three task areas: perception, interaction and learning. Perception includes detection, localization, classification, identification, and tracking of features relevant to unmanned ground vehicle (UGV) driving, coupled to integrated object-oriented representations to support mapping and navigation. Interaction includes developing tasking, monitoring, and intervention interfaces for operator and supervisor modes, as well as developing interaction modalities with other drivers and pedestrians in a driving context. Tools will be required to measure operator monitoring and intervention requirements.	TBD	BAA2QFY02 Total program: 5 years	Dr. Douglas W. Gage IPTO

Learning technologies will be assessed in the UGV driving context for behavior selection, tuning of behavior parameters, and tuning of perceptual classification.			
High Productivity Computing Systems (HPCS): The HPCS program will fill a DoD high-end computing gap between today's late 80s-based high performance computing based on technology from the late 1980s and the promise of quantum computing. DARPA's "Grand Challenge" is to develop a broad spectrum of innovative technologies, integrated into a balanced total system solution by the end of this decade. The end product will be economically viable, high productivity computing systems with both scalable vector and commodity HPC system functionality for the national security and industrial user communities with performance, productivity, portability, and robustness as key design attributes. Industry adoption is seen as a central strategy to ensure that cost-effective solutions are made available to the national security community.	TBD	BAA 1QFY02 Total program: 9 years	Mr. Robert Graybill IPTO
Model-Based Integration of Embedded Systems (MoBIES): The MoBIES program began in FY00 as a technology development effort to integrate models of underlying physical application domains with models of embedded software design procedures in order to tailor embedded software design tools to the target environment. If successful, MoBIES will commoditize the production of domain-specific programming tools and correct-by-construction code generation technologies that will revolutionize the production of highly complex but easily verifiable embedded systems. The major task areas include programmable modeling environments, design and analysis tools (e.g., optimization and verification), model-based generators, and open experimental platforms. MoBIES program goals comprise: (1) 10X increase in the complexity of code that can be reliably generated per unit time; (2) 50% reduction in the cost of application-tailored embedded system development toolsets, with a 10X increase in application-specific tool availability; (3) 50% reduction in the cost to verify and validate automatically generated embedded system software; and (4) 25%	TBD	BAA2QFY02	Dr. John Bay IPTO

reduction in the number of software bug-fixes required for embedded systems. This follow-on BAA will solicit integrators and evaluators for diverse embedded system domains, additional tool components, and tool suite system architects. With the addition of these capabilities, the MoBIES program will result in an open framework and open representations for modular, composable, embedded system productivity tools.			
Effective, Affordable, Reusable Speech-to-Text (EARS): EARS will produce powerful new speech-to-text (automatic transcription) technology whose outputs are substantially richer and much more accurate than currently possible. The program focuses on natural, unconstrained human-human speech from broadcasts and telephone conversations in a number of languages. The intent is to create core enabling technology suitable for a wide range of advanced applications (including many critical to national security), producing substantial improvements in what people and machines can do and also laying the groundwork for bold new initiatives in automatic language exploitation. Specific objectives include: (1) word error rates in the 5-10% range; (2) useful metadata of various kinds extracted from the signal; (3) readable transcripts (with standard punctuation, formatting, etc); (4) domain-, topic-, speaker-, style-, and vocabulary-independent technology; (5) robustness with respect to variations in channel and speaking environment; (6) multiple source languages (including varieties of English, Chinese, and Arabic); (7) portable to an arbitrary language with one week of concerted effort; (8) executable in real-time (or faster) with standard hardware (one processor); and (9) commercialization of successful technology.	TBD	BAA 02-06 Proposals due:11/8/02 Total program: 5 years	Mr. Charles Wayne IPTO

Adaptive and Reflective Middleware Systems (ARMS): New and planned DoD combat systems, such as total ship computing environments, next-generation coordinated unmanned air vehicle systems, and area/theater ballistic missile defense, are network-centric, distributed, real-time, and embedded (DRE) “systems of systems” whose challenging requirements can be characterized as follows: (1) multiple quality of service properties, such as predictable latency/jitter/throughput, scalability, dependability, and security, must be satisfied simultaneously and often in real-time; (2) different levels of service will occur under different configurations, environmental conditions, and costs and must be handled judiciously by combat system infrastructure and applications; (3) the levels of service in one dimension must be coordinated with and/or traded off against the levels of service in other dimensions to achieve the intended application and overall mission results; and (4) the need for autonomous and time-critical application behavior requires flexible system infrastructure components that can adapt robustly to dynamic changes in mission requirements and environmental conditions. The objective of the ARMS program is to develop and validate the new generation of distributed real-time and embedded middleware combat system technologies that can adapt dependably in response to dynamically changing conditions (e.g., during a battle) for the purpose of always utilizing the available computer and network infrastructure to the highest degree possible in support of mission needs.	TBD	BAA2QFY02 Total program: 5 years	Dr. Douglas SchmidtIPTO

Software for Distributed Robotics (SDR): The SDR program develops robot behavior and coordination software that can run on extremely resource-limited small robots in order to allow large ensembles of these robots to perform useful tasks in the real world. The program also develops human-robot interface technologies to permit humans to task and query the system as a collective, without having to interact with robots individually. The aim is to exploit the opportunities presented by scalability of robot numbers, subject to the constraints of scalability of robot size. In Phase 1, which has been completed, specific component areas of interest included coordinated behaviors, inter-robot communications, human-robot interface, and computational architecture. In Phase 2, the phase planned for solicitation, these technologies will be integrated to develop robot systems to conduct reconnaissance and surveillance inside buildings using colonies of 100 or more robots. This application spans the complete mission profile from tasking and deployment to recovery and performance assessment, and involves mobility, localization, mapping, search, detection, classification, tracking, and reporting of “threat” targets.	TBD	BAA2QFY02 Total program: 4 years	Dr. Douglas W. Gage IPTO
Babylon: The Babylon program will lead to a rapid, two-way, multilingual speech translation interfaces for users in combat and other field environments. The program will attack the hard, unsolved problems involved in speech translation technologies including multilingual automatic speech recognition (ASR), parsing, semantic knowledge representation, portability between languages and domains, robustness in noise and distortions based on channel effects. Specifically, the program will overcome the many technical and engineering constraints limiting ASR robustness, translation accuracy, and response time of current translation technology. Babylon will provide an enabling technology to give language support to the warfighter in deciphering possibly critical language communications during operations in foreign territories. Specifically, the Babylon translation capabilities will be useful to personnel in Special Forces, crisis response, intelligence (interview/interrogation), and check points.	TBD	BAA2QFY02 Total program: 3 years	LTC James D. Bass IPTO

Reliable Omnipresent Automatic Recognition (ROAR): The ROAR program, also known as Speech in Noisy Environments (SPINE), will lead to hands-free, eyes-free, user interfaces for noisy environments. The program will attack the hard, unsolved problems associated with automatic speech recognition (ASR) in noisy, multi speaker environments. Specifically the program will focus on overcoming the many mathematical and environmental constraints limiting ASR robustness. ROAR will provide an enabling technology to support applications that require a speech interface for noisy and/or multi-speaker speech capabilities. In addition, the program will evaluate the operational utility of robust speech recognition technology in realistic military experiments. The technology transition effort of the program will be stimulated through coordination with battle labs. These experiments will feature command and control systems with robust speech recognition that will dramatically improve overall performance for information intensive tasks under stressful or multi-speaker environments.	TBD	BAA 01-44 Proposals due: 5/7/02 Revised BAA2QFY02 Total program:5 years	LTC James D. Bass IPTO
Wargaming the Asymmetric Environment (WAE): The WAE program seeks to develop and demonstrate techniques to significantly increase the decision-maker's ability to develop an integrated situational awareness through rapidly exploring the asymmetric planning space. WAE will develop automated and adaptive behavioral models “tuned” to specific asymmetric adversaries. These models will augment a decision makers predictive capability in the following areas: (1) early detection of potential threats; (2) automated mapping of threat attributes to potential targets; (3) assessment of the potential target’s vulnerability; (4) assessment of the potential threat’s vulnerability; and (5) automated emulation tools to support hypothesis testing of force protection and interdiction strategies. The program will develop and evaluate a wide variety of predictive and emulation technologies to support modeling asymmetric threat behavior. The program technical approach will be accomplished through the following four tasks. First, predictive modeling to develop and evaluate a variety of predictive technologies to support modeling asymmetric threat behavior	TBD	N61339-01-R-0001, Amendment 0003Open through: 12/31/05Total program:5 years	Larry Willis IPTO

(e.g., method of attack, target characteristics, geographical region of attack, and estimated timeframes for the attack). Research will empirically assess the predictive contribution of the following factors currently used by the intelligence community, DoD, and non-DoD organizations: intrinsic (biases, personality, cognitive style, etc.) and extrinsic (political, cultural, economic, etc.) influences into behavior, decision-making and planning models. Second, model generalization to develop and evaluate techniques to generalize predictive models from individual to classes of asymmetric threats. Generalization research will focus on empirical research of the threat behaviors, the behavior antecedents, and the behavior consequences. Candidate clustering technologies will include neural nets, evolutionary programming, and factor analysis. Third, behavior emulation to develop and evaluate technologies to support behavioral emulation of multiple entities and their respective interactions in a single gaming environment to support hypothesis testing. Candidate technologies will include game theoretic and various hybrids advanced reasoning techniques. Lastly, develop a test and validation environment to support the simulation, evaluation, and validation of predictive, generalization, and emulation techniques, models and technologies.			
Evidence Extraction and Link Discovery: The EELD program seeks to significantly advance the state-of-the-art in Evidence Extraction (EE), Link Discovery (LD), and Pattern Learning (PL) technology to enable the construction of prototype systems that can be used for asymmetric threat detection. Evidence extraction technology will extended the ability to extract relationships between entities and attributes of these relationships. Link discovery technology will enable the discovery of related entities, additional attributes, and other relevant relationships for a scenario of interest. Pattern learning technology will enable learning from scenario patterns or models to facilitate the extraction and discovery of additional instances of scenarios of interest. The EELD system would extract entities, relationships, and their attributes from textual or semi-structured data sources, integrate facts from structured databases, create	$40M	BAA 01-27Open through: 1/31/02Total program:5 years	Ted Senator IPTO

and update profiles of entities and scenarios of events, link together related entities and events, and evaluate these linked structures for activities of interest. The system is expected to learn from small numbers of examples/models of scenarios of interest to guide the evidence extraction and link discovery processes. The primary research foci are: (1) evidence extraction: approaches for extracting relational facts; (2) link discovery: approaches for discovering relevant linkages between entities, reasoning about different levels of abstraction, classifying the emerging and suspected instances of patterns of interest, and reasoning with multiple hypotheses and with uncertainty; (3) pattern learning: approaches for enabling a system to learn, from a small number of example instances consisting of data about entities, relationships, and their attributes, models of scenarios of interest; and (4) system concept and performance analysis.			
Networking in the Extreme: The NETEX program will develop new networking technologies to enable distributed sensor networks to be effective in urban and other harsh complex environments. The primary approach is to use the digital, ultrawideband technology for the physical layer, with the focus on short to medium distance coverage. The program will pursue basic technology development for ultrawideband networking, and is expected to have a significant impact on the future military networking capabilities. The program is broken into two phases. During the first phase, new UWB networking and geo-localization hardware and software will be developed, and cluster sub networks will be demonstrated. These tasks will be driven by an in-depth quantitative assessment of extreme operating environments and applications concept. The tasks are highly interactive and co-dependent, and iterative refinements are expected. Phase 1 ends with mid-term experiments testing new algorithms and protocols on a modest number of nodes. Phase 2 will focus on tightly focused development and integration of the best algorithms and capabilities into the UWB networking and geo-localization system. The final experiment will test scalable, precision geo-localization capability together with sensor blanket demonstration using a mix of UWB sub networks.	TBD	BAA 01-46 Open through: 8/7/02 Total program:5 years	Mari Maeda IPTO